REC'D 17 AUG 2005
WIPO PCT

PATENT COOPERATION TREATY

PCT

INTERNATIONAL PRELIMINARY EXAMINATION REPORT

(PCT Article 36 and Rule 70)

Applicant's or agent's file reference P 03 006 WO	**FOR FURTHER ACTION** See Notification of Transmittal of International Preliminary Examination Report (Form PCT/IPEA/416)	
International application No. PCT/DK2003/000196	International filing date *(day/month/year)* 21.03.2003	Priority date *(day/month/year)* 21.03.2003
International Patent Classification (IPC) or both national classification and IPC F03D11/04		
Applicant VESTAS WIND SYSTEMS A/S et al.		

1. This international preliminary examination report has been prepared by this International Preliminary Examining Authority and is transmitted to the applicant according to Article 36.

2. This REPORT consists of a total of 6 sheets, including this cover sheet.

☒ This report is also accompanied by ANNEXES, i.e. sheets of the description, claims and/or drawings which have been amended and are the basis for this report and/or sheets containing rectifications made before this Authority (see Rule 70.16 and Section 607 of the Administrative Instructions under the PCT).

These annexes consist of a total of 11 sheets.

3. This report contains indications relating to the following items:

- I ☒ Basis of the opinion
- II ☐ Priority
- III ☐ Non-establishment of opinion with regard to novelty, inventive step and industrial applicability
- IV ☐ Lack of unity of invention
- V ☒ Reasoned statement under Rule 66.2(a)(ii) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement
- VI ☐ Certain documents cited
- VII ☐ Certain defects in the international application
- VIII ☐ Certain observations on the international application

Date of submission of the demand 06.08.2004	Date of completion of this report 16.08.2005
Name and mailing address of the international preliminary examining authority: European Patent Office D-80298 Munich Tel. +49 89 2399 - 0 Tx: 523656 epmu d Fax: +49 89 2399 - 4465	Authorized Officer Sampatakos, I Telephone No. +49 89 2399-2336

INTERNATIONAL PRELIMINARY EXAMINATION REPORT

International application No. PCT/DK2003/000196

I. Basis of the report

1. With regard to the **elements** of the international application *(Replacement sheets which have been furnished to the receiving Office in response to an invitation under Article 14 are referred to in this report as "originally filed" and are not annexed to this report since they do not contain amendments (Rules 70.16 and 70.17))*:

Description, Pages

1-25 as originally filed

Claims, Numbers

1-53 filed with telefax on 15.06.2005

Drawings, Sheets

1/10-10/10 as originally filed

2. With regard to the **language**, all the elements marked above were available or furnished to this Authority in the language in which the international application was filed, unless otherwise indicated under this item.

These elements were available or furnished to this Authority in the following language: , which is:

- ☐ the language of a translation furnished for the purposes of the international search (under Rule 23.1(b)).
- ☐ the language of publication of the international application (under Rule 48.3(b)).
- ☐ the language of a translation furnished for the purposes of international preliminary examination (under Rule 55.2 and/or 55.3).

3. With regard to any **nucleotide and/or amino acid sequence** disclosed in the international application, the international preliminary examination was carried out on the basis of the sequence listing:

- ☐ contained in the international application in written form.
- ☐ filed together with the international application in computer readable form.
- ☐ furnished subsequently to this Authority in written form.
- ☐ furnished subsequently to this Authority in computer readable form.
- ☐ The statement that the subsequently furnished written sequence listing does not go beyond the disclosure in the international application as filed has been furnished.
- ☐ The statement that the information recorded in computer readable form is identical to the written sequence listing has been furnished.

4. The amendments have resulted in the cancellation of:

- ☐ the description, pages:
- ☐ the claims, Nos.:
- ☐ the drawings, sheets:

5. ☐ This report has been established as if (some of) the amendments had not been made, since they have been considered to go beyond the disclosure as filed (Rule 70.2(c)).

   (Any replacement sheet containing such amendments must be referred to under item 1 and annexed to this report.)

6. Additional observations, if necessary:

V. Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement

1. Statement

Novelty (N)	Yes:	Claims	1-44,52,53
	No:	Claims	45
Inventive step (IS)	Yes:	Claims	1-44,52,53
	No:	Claims	46-51
Industrial applicability (IA)	Yes:	Claims	1-53
	No:	Claims	

2. Citations and explanations

see separate sheet

Re Item V

Reasoned statement with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement

1. The present invention relates to the methods of moving and/or controlling the rotating means of a wind turbine during transportation or stand still and a corresponding auxiliary device according to claims 1, 12, 19, 26, 36 and 52 respectively.

   The transportation of a wind turbine over long distances involves problems as the nacelle includes a number of components with rotating means. During the long transportation the protective oil films that separates the rotating means from the bearing and toothed wheels from each other may be ruptured or vanish due to vibrations and the weights of the shaft, resulting in damage to the shafts, bearings or the toothed wheels.
   In GB-A-2 201 200 (D1) a method is disclosed of maintaining operational lubrication by an oil-circulated system with injection lubrication, with the oil being cooled at the same time. However, it does not solve said problem during transportation or stand still during transportation.

   With the features of claims 1 or 12, a method is provided having an auxiliary device which moves the rotating means continuously or discontinuously from a position to another during the transportation or during stand still during transportation. Herewith, said problem of single-sided load of the rotating means is solved.

   Claim 19 is directed to a method of controlling the above moving containing the crucial features of the auxiliary device as in Claims 1 and 12.

   Claim 26 is directed to a nacelle for a wind turbine having at least one auxiliary device moving the rotating means during transportation or stand still.

Claim 36 is directed to the auxiliary device as such, while claim 52 is claiming the use of said auxiliary device.

None of the prior art documents which have become known to this Authority discloses all the technical features of independent claims 1, 12, 19, 26, 36 or 52.

Furthermore, the solution to the above mentioned problem in said claims of the present application is considered as involving an inventive step (Article 33(3) PCT), since it is not taught or suggested by the prior art documents.

2. Claims 2-11, 13-18, 20-25, 27-35, 37-44 and 53 are dependent on claims 1, 12, 19, 26, 36 or 52, respectively, and as such also meet the requirements of the PCT with respect to novelty and inventive step.

3. Due to the term "for" used in claim 45, which can be interpreted as "suitable for", the auxiliary device according to any of claims 36 to 44 is optional and consequently does not form a restricting part of the claimed system. However, these features appear to be essential for claim 45 and therefore said claim is not complete and consequently unclear (Article 6 PCT).

4. As a further consequence of the above-mentioned lack of clarity, the subject-matter of claim 45 appears not novel in the sense of Article 33(2) PCT, and therefore the criteria of Article 33(1) PCT are not met, since this claim essentially specifies only a control/monitoring system and a corresponding method including algorithms comprising inputs signal from one or more sensors and/or time signal and deriving an output signal in order to control a device, which features are as such apparently well known in the art.

5. Dependent claims 46-51 do not appear to contain any additional features which, in combination with the features of any claim to which they refer, meet the requirements of the PCT with respect to inventive step, because they are also standard technical knowledge.

Further Remarks:

1. The features of the claims are not provided with reference signs placed in parentheses (Rule 6.2(b) PCT).

2. Contrary to the requirements of Rule 5.1(a)(ii) PCT, the relevant background art disclosed in the document DI is not mentioned in the description.

Claims

1. Method of moving the rotating means of a wind turbine during transportation, said method comprising the steps of:

   securing at least one auxiliary device to a fixed position in relation to said rotating means,

   connecting said at least one auxiliary device to the rotating means at the transportation, said least one auxiliary device being able to store; generate and/or convert energy during transportation,

   transferring energy from said at least one auxiliary device to said one or more shafts of the rotating means during transportation, and

   moving said one or more shafts of the rotating means continuously or discontinuously from a position to another.

2. Method of moving the rotating means according to claim 1, wherein said rotating means is included in a nacelle of a wind turbine or in a transportation frame construction.

3. Method of moving the rotating means according to claim 1 or 2, wherein said auxiliary device is connected to one or more shafts such as the high-speed shaft at the gear and/or the generator.

4. Method of moving the rotating means according to any of claims 1 to 3, wherein the moving of said one or more shafts are turned at a very low turning speed such as less than one full turn per week e.g. between 1 and 20 degrees per day.

5. Method of moving the rotating means according to any of claims 1 to 4, wherein the moving of said rotating means is discontinuous e.g. between 30 seconds and 20 minutes of movement every period such as 1 minute movement every 3 hours.

6. Method of moving the rotating means according to any of claims 1 to 5, wherein the moving of said one or more shafts of the rotating means is combined with oil lubrication at said rotating means.

7. Method of moving the rotating means according to any of claims 1 to 6, wherein said method activates or controls one or more oil lubrication pumps supplying lubrication to said rotation means.

8. Method of moving the rotating means according to any of claims 1 to 7, wherein said auxiliary device and/or said one or more oil lubrication pumps is activated or controlled continuous or discontinuously.

9. Method of moving the rotating means according to any of claims 1 to 8, wherein said transportation is performed with transportation means such as trucks, trains or ships.

10. Method of moving the rotating means according to any of claims 1 to 9, wherein said auxiliary device is connected to one or more energy generating systems of said transportation means such as the electric generators, pneumatic or hydraulic pumps.

11. Method of moving the rotating means according to any of claims 1 to 10, wherein said auxiliary device is connected to said rotating means before start of the transportation.

12. Method of moving the rotating means of a wind turbine during stand still during transportation, said method comprising the steps of:

at least one auxiliary device being secured to a fixed position in relation to said rotating means and connected to the rotating means, said at least one auxiliary device being able to store, generate and/or convert energy during stand still,

transferring energy from said at least one auxiliary device to said one or more shafts of the rotating means during stand still, and

moving said one or more shafts of the rotating means continuously or discontinuously from a position to another.

13. Method of moving the rotating means according to claim 12, wherein said rotating means is included in a nacelle of a wind turbine or in a transportation frame construction.

14. Method of moving the rotating means according to claim 12 or 13, wherein the moving of said rotating means are turned at a very low turning speed such as less than one full turn per week e.g. between 1 and 20 degrees per day.

15. Method of moving the rotating means according to any of the claims 12 to 14, wherein the moving of said rotating means is discontinuous e.g. between 30 seconds and 20 minutes of movement every period such as 1 minute movement every 3 hours.

16. Method of moving the rotating means according to any of claims 12 to 15, wherein said auxiliary device is connected to one or more separate energy generating systems such as the public electricity grid.

17. Method of moving the rotating means according to any of claims 12 to 16, wherein said method activates or controls one or more oil lubrication pumps supplying lubrication to said rotation means.

18. Method of moving the rotating means according to any of claims 12 to 17, wherein said auxiliary device and/or said one or more oil lubrication pumps are activated or controlled continuous or discontinuously.

19. Method of controlling the moving of the rotating means of a wind turbine during transportation or stand still during transportation, said method includes

control and monitoring system including an algorithm, said system comprising inputs signal from one or more of sensors,

connecting at least one auxiliary device to the rotating means at the transportation, said least one auxiliary device being able to store, generate and/or convert energy during transportation,

controlling said at least one auxiliary device with output signals of said control and monitoring system in order to move the rotating means of the wind turbine during transportation or stand still,

wherein said output signal is derived from said input signals and/or time signals.

20. Method of moving the rotating means according to claim 19, wherein said sensors may include energy level monitoring means monitoring the remaining energy of the energy storage or storages, temperature sensors monitoring external and/or internal temperature of one or more components, pressure sensors monitoring the oil lubrication pressure levels, one or more vibration sensors and/or sensor combinations thereof.

21. Method of moving the rotating means according to claim 19 or 20, wherein said rotating means is part of a nacelle of a wind turbine.

22. Method of controlling the moving of the rotating means according to any of claims 19 to 21, wherein the time signals reflect the period or periods of stand still of said rotating means.

23. Method of controlling the moving of the rotating means according to any of claims 19 to 22, wherein the turning speed of the rotating means is lowered or converted from a continuous to a discontinuous drive at low energy levels by the control system. .

24. Method of moving the rotating means according to any of claims 19 to 23, wherein said method activates or controls one or more oil lubrication pumps supplying lubrication to said rotation means.

25. Method of moving the rotating means according to any of claims 19 to 24, wherein said system activates or controls said auxiliary device and/or said one or more oil lubrication pumps continuous or discontinuously.

26. Nacelle for a wind turbine defining an enclosed space, said nacelle comprising

rotating means such as gear (17) and/or generators (21) including one or more shafts (16, 19), and

at least one auxiliary device (14) being secured to a fixed position in the nacelle with securing means (18, 28) and connected to said rotation means with connection means (15),

wherein said auxiliary device (14) moves the rotating means of the wind turbine nacelle during transportation or stand still during transportation of said wind turbine nacelle.

27. Nacelle for a wind turbine according to claim 26, where said connection is established to one or more shafts (16, 19, 32) of said rotation means such as the high-speed shaft (16, 32) at the gear (17) and/or generator (21).

28. Nacelle for a wind turbine according to claim 26 or 27, where said connection means (15) is a belt arrangement including a belt (15), belt pulleys (24b) at said one or more shafts (16, 19, 32), at least one bracket (28) secured to a position in the nacelle and a belt pulley (24a) of said at least one auxiliary device (14).

29. Nacelle for a wind turbine according to any of claims 26 to 28, where the gear and/or the generator belt pulleys (24b) have different sizes in relation to belt pulley (24a) of said at least one auxiliary device (14) e.g. being significantly larger in diameter.

30. Nacelle for a wind turbine according to any of claims 26 to 29, where said connection means is a cardan coupling system (25) flexibly connecting the high-speed shaft ends (32) of the gear and/or the generator with said at least one auxiliary device (14).

31. Nacelle for a wind turbine according to claim 30, where said cardan shaft system (25) includes gearing means (27) in the connection between the shafts and said at least one auxiliary device (14).

32. Nacelle for a wind turbine according to any of claims 26 to 31, where the transportation is performed with transportation means (6) such as trucks, trains or ships.

33. Nacelle for a wind turbine according to claim 32, where the auxiliary device is connected to one or more of the energy generating systems of the transportation means (6) such as the electric generators, pneumatic or hydraulic pumps.

34. Nacelle for a wind turbine according to any of claims 26 to 33, where the rotating means is mounted on the nacelle (3) with flexible rubber bushings.

35. Nacelle for a wind turbine according to any of claim 26 to 34, where the nacelle further comprises one or more oil lubrication pumps (20) supplying lubrication to said rotation means.

36. Auxiliary device (14) for moving the rotating means of a wind turbine during transportation or stand still during transportation of said wind turbine, said device comprising

    securing means (18) for securing the auxiliary device (14) to a fixed position in relation to said rotating means,

    connection means (15) for connecting the auxiliary device (14) to the rotating means

    converting means for converting an internal or external energy source to mechanical force,

    where said connection means (15) continuously or discontinuously transfers the mechanical force to the rotating means through said connection to the rotating means.

37. Auxiliary device (14) according to claim 36, where the connection means (15) is connected to the shaft of the rotating means such as the high-speed shaft (16, 32) of the gear (17) and/or the generator (21).

38. Auxiliary device (14) according to claim 36 or 37, where said connection means (15) is a belt arrangement including a belt (15), belt pulleys (24b) at said one or

more shafts, at least one bracket (28) secured to a position in the nacelle and a belt pulley (24a) of said at least one auxiliary device (14).

39. Auxiliary device (14) according to any of the claims 36 to 38, where the gear and/or the generator belt pulleys (24b) have different sizes in relation to belt pulley (24a) of said at least one auxiliary device (14) e.g. being significantly larger in diameter.

40. Auxiliary device (14) according to claim 36, where said connection means is a cardan coupling system (25) flexibly connecting the high-speed shaft ends (32) of the gear and/or the generator with said at least one auxiliary device (14).

41. Auxiliary device (14) according to claim 40, where said cardan shaft system includes gearing means (27) in the connection between the shafts (32) and said at least one auxiliary device (14)

42. Auxiliary device (14) according to any of claims 36 to 41, where said internal or external energy source may be selected from a first group of energy sources comprising:

motors supplied with electric power,

engines fuelled with diesel, gasoline or other fossil fuels,

helical or leaf spring means or torsion bars, or

pneumatic or hydraulic systems supplied with compressed air or hydraulic oil, respectively.

43. Auxiliary device (14) according to any of claims 36 to 42, where said internal or external energy source may be selected from a second group of redundant energy sources comprising:

electric accumulators,

pneumatic or hydraulic storages,

and/or

solar cells such as movable carpets of solar cells.

44. Auxiliary device (14) according to any of claims 36 to 43, where said auxiliary device (14) is connected to said rotating means before start of the transportation or stand still.

45. Control and monitoring system (34) for controlling the moving of the rotating means of a wind turbine (1) with at least one auxiliary device (14) according to any of claims 36 to 44 during transportation or stand still during transportation, said system comprising

input signals from one or more sensors,

at least one time signal generator, and

one or more algorithms

where said at least one auxiliary device (14) is connected to the rotating means at the transportation, said least one auxiliary device being able to store, generate and/or convert energy during transportation, and

wherein said at least one auxiliary device (14) is controlled with output signals from said one or more algorithms in order to move the rotating means of the wind turbine during transportation or stand still, said output signal being derived from said input signals.

46. Control and monitoring system (34) according to claim 45, where said one or more sensors may be energy level monitoring means monitoring the remaining energy of the energy storage or storages, pressure sensors monitoring the oil lubrication pressure levels, temperature sensors monitoring external (ES) and/or internal temperature of one or more components, one or more vibration sensors (ES) and/or sensor combinations thereof.

47. Control and monitoring system (34) according to claim 45 or 46, where said system further controls and monitors one or more oil lubrication pumps (20) supplying lubrication to said rotation means.

48. Control and monitoring system (34) according to any of claims 45 to 47, where said system activates or controls said auxiliary device (14) and/or said one or more oil lubrication pumps (20) continuous or discontinuously.

49. Control and monitoring system (34) according to any of claims 45 to 48, where said system further transmits output information signals regarding the transportation or stand still e.g. alarm or fail signals to one or more remote places such as a remote control center (35).

50. Control and monitoring system (34) according to claim 49, where said output information signals may include data identifying the nacelle (3) or the rotating means, the reason for the alarm or fail signal and preferably the position of the nacelle.

51. Control and monitoring system (34) according to claim 49 or 50, where said output information signals are wireless signals such as using mobile telephone systems together with GPS systems or satellite based maritime communication systems.

52. Use of an auxiliary device according to any of claims 36 to 44 and/or control and monitoring system according to any of claims 45 to 51 as a unit for supplementary connection to one or more shafts (16, 19, 32) of rotating means in a wind turbine (1) at transportation or other types of stand still.

53. Use according to claim 52, where said unit is connected to the high-speed shafts (16) of the gear (17) and/or generator (21).